

California's Bay-Delta

History and Management Issues



Overview

Background

Risks

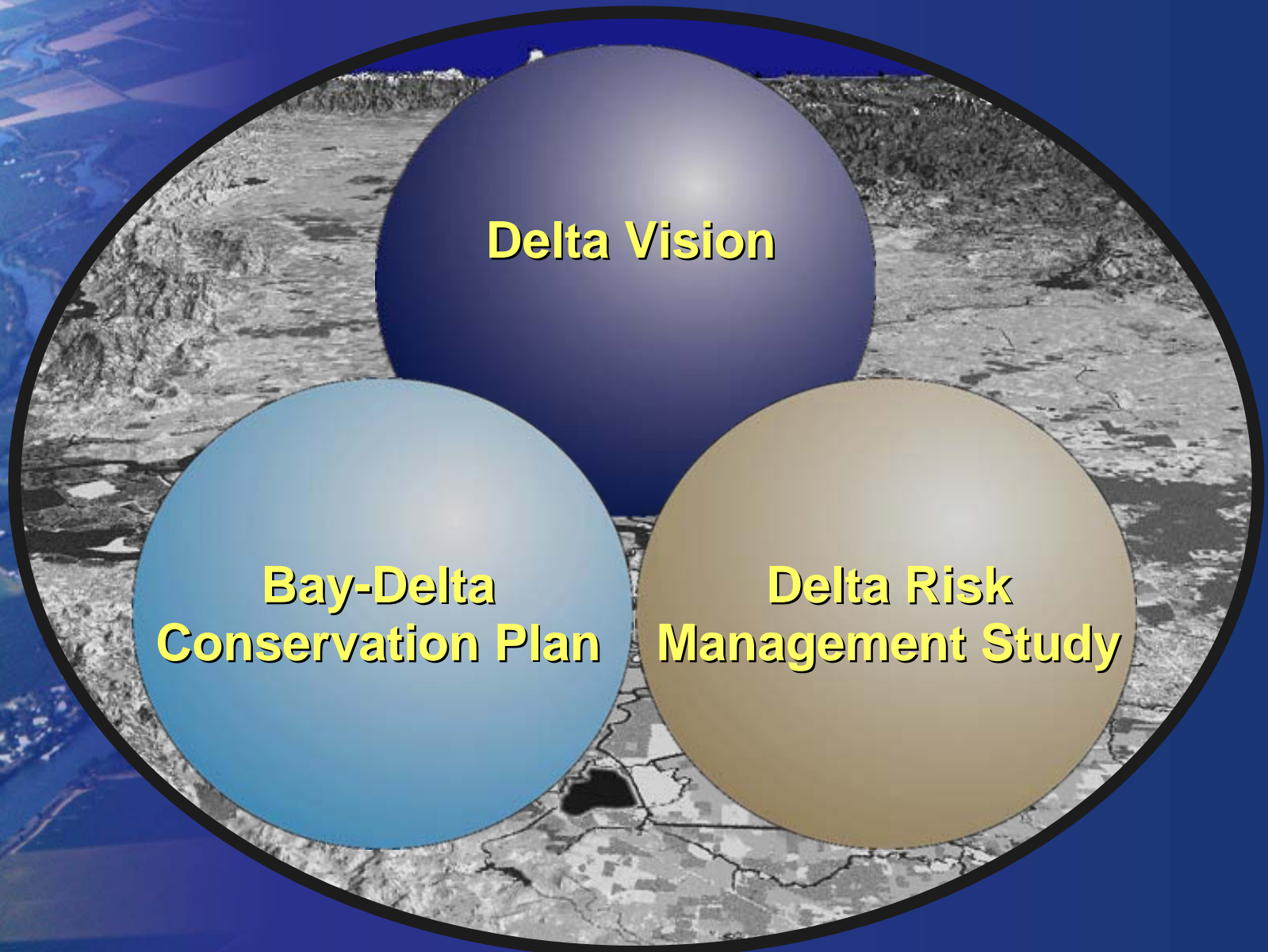
Consequences



What We Know

- **California's economy facing water supply risks**
 - **Katrina-like natural disaster**
 - **Reductions due to fishery conflicts**
- **The Delta ecosystem is fragile and threatened**
- **There are solutions**
 - **Short-term, Next decade, Long-term**
- **Delta solutions need statewide support**

Major Long-term Delta Actions



California's Bay-Delta

History and Management Issues



Overview

Background

Risks

Consequences

Sacramento-San Joaquin Delta

Legal Delta and Zones

- Primary Zone
- Secondary Zone
- County Boundary
- Surface Streets
- Major Highways
- Hydrography
- Delta Primary Zone
- Delta Secondary Zone

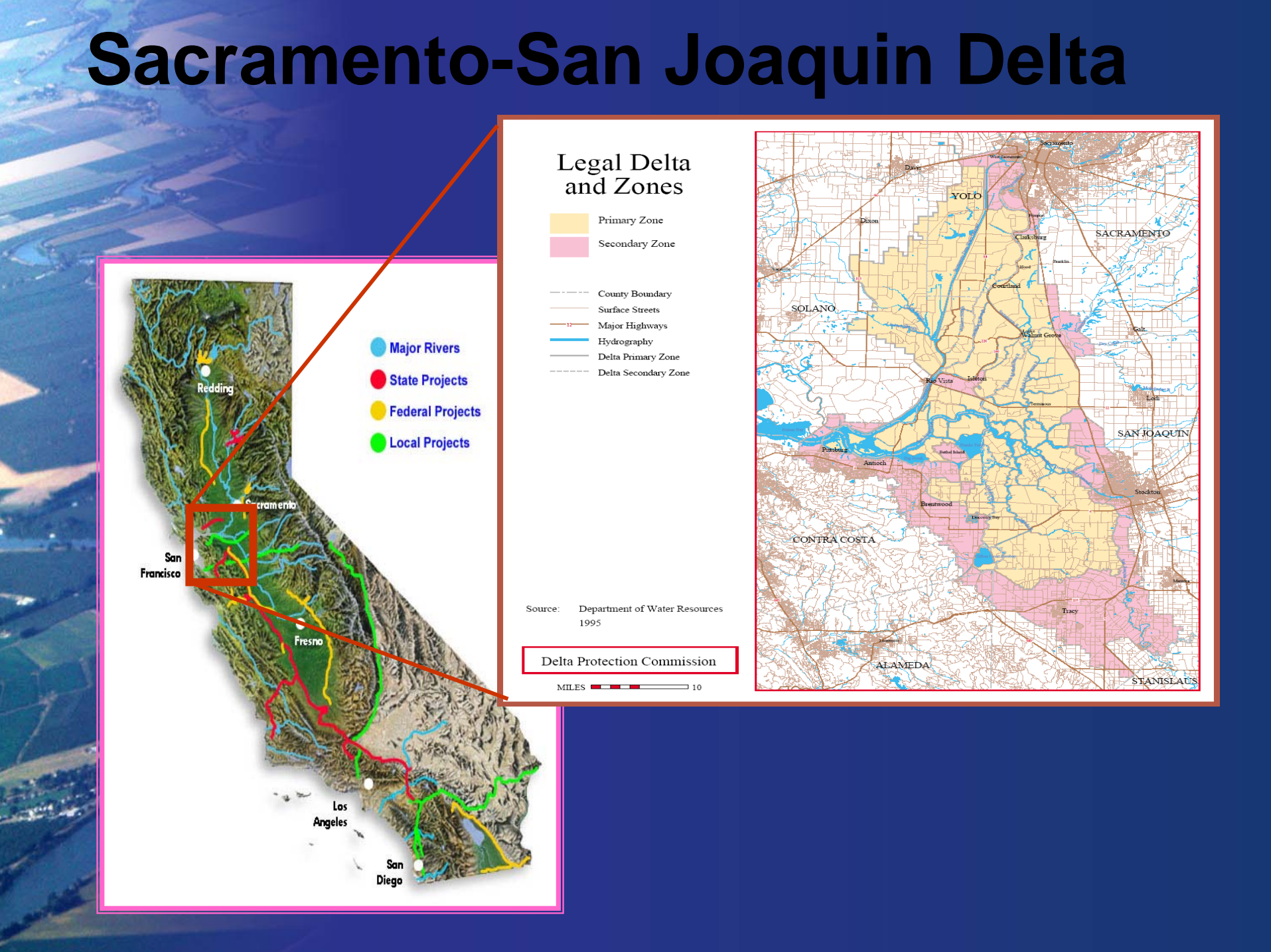
Source: Department of Water Resources 1995

Delta Protection Commission

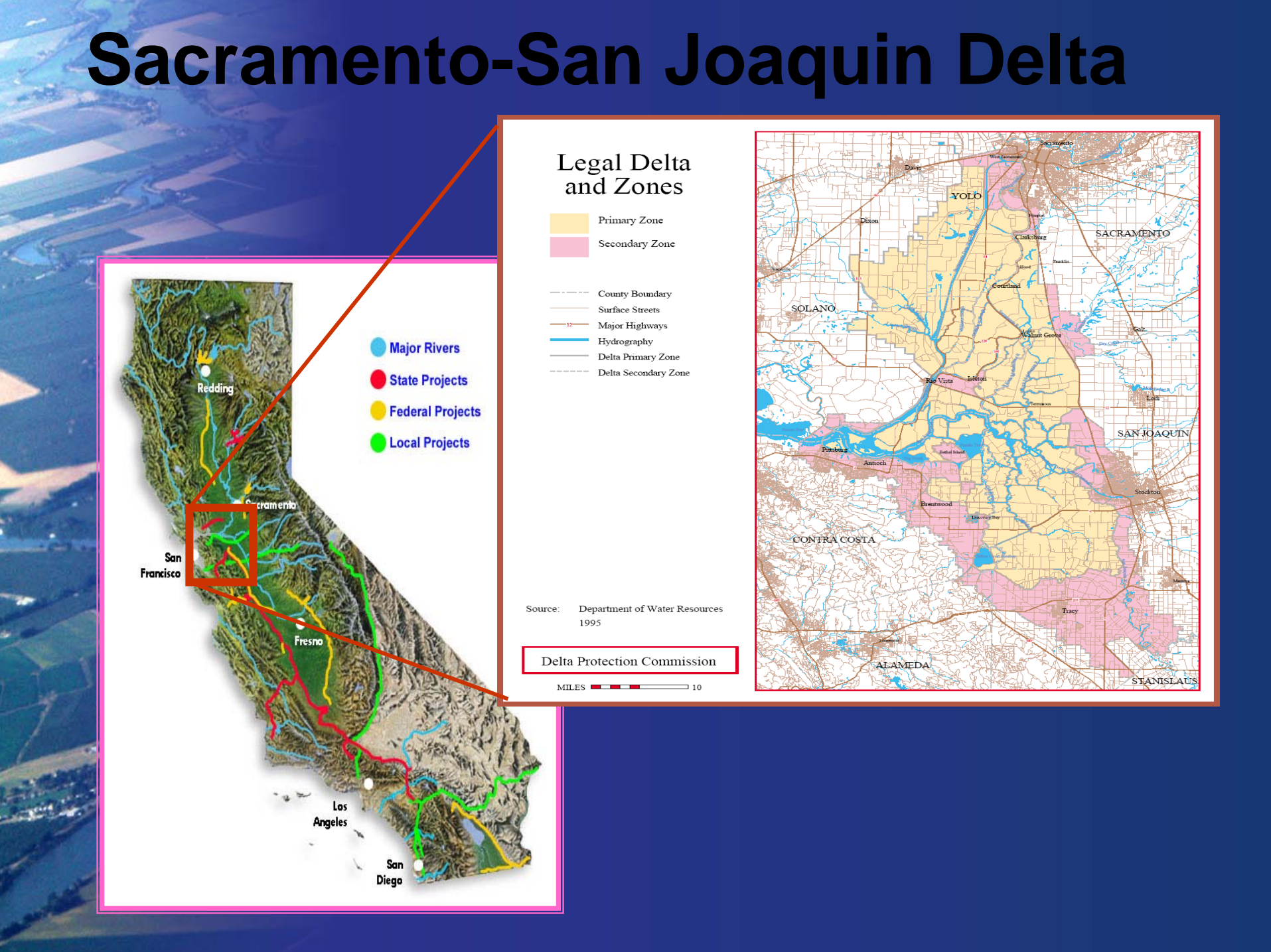
MILES 10

Map of California showing the Sacramento-San Joaquin Delta region highlighted in red. Major cities labeled include Redding, Sacramento, San Francisco, Fresno, Los Angeles, and San Diego.

Map of the Sacramento-San Joaquin Delta region showing the Sacramento and San Joaquin rivers, major cities (Sacramento, Yolo, Solano, Contra Costa, Alameda, Stanislaus), and project zones (Primary Zone, Secondary Zone).



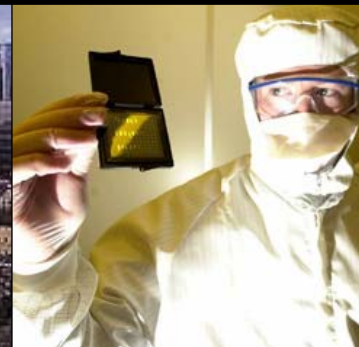
MILES 10



Importance of the Bay-Delta

- 2/3 of California (23 million residents) rely on Delta water

Urban Needs



Importance of the Bay-Delta

■ Supplies Bay Area, Central Valley & So. California

Bay Area – 33%

Kern County – 23%

Southern California – 30%

Some regions up to 100%
dependent on the Delta

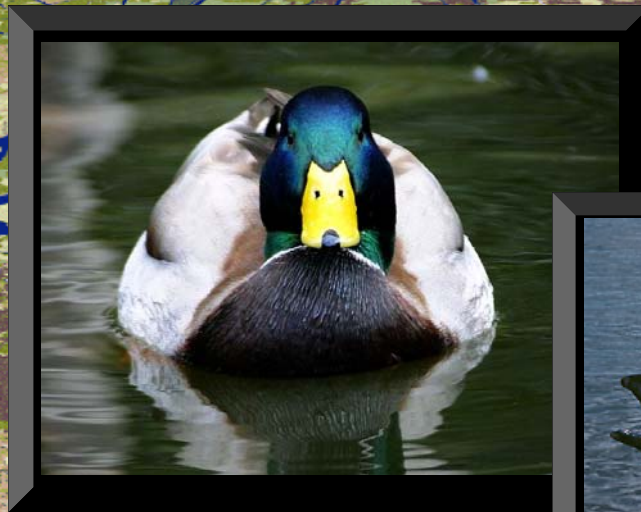
Importance of the Bay-Delta

- Irrigates 45% of the fruits & vegetables produced in US



Importance of the Bay-Delta

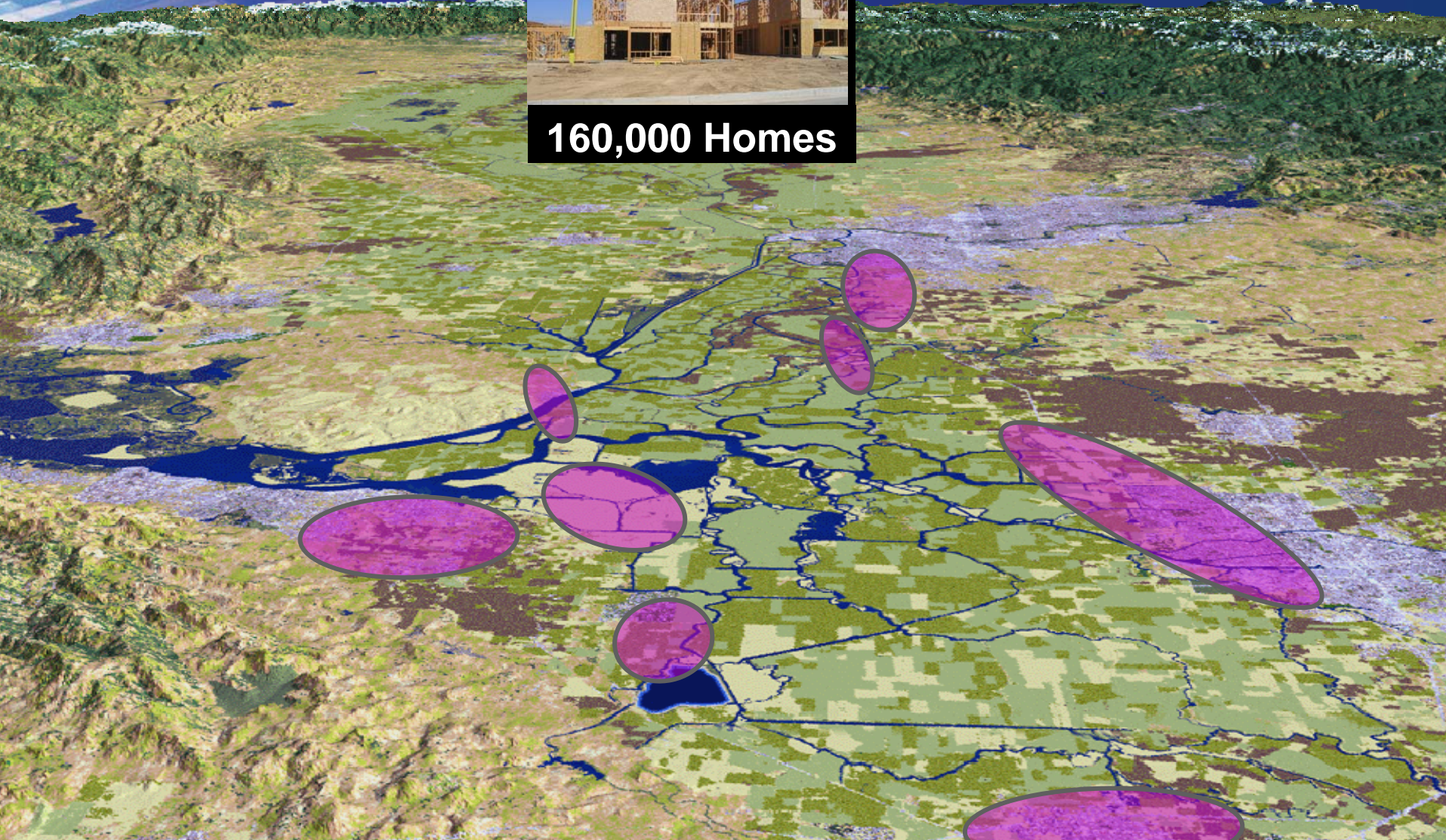
- 80% of the state's commercial fishery species live in or migrate through the Bay-Delta
- Habitat for 700 species, including 5 ESA listed species
- Largest estuary on the west coast of the Americas



Importance of the Bay-Delta



160,000 Homes



Importance of the Bay-Delta



3 Highways



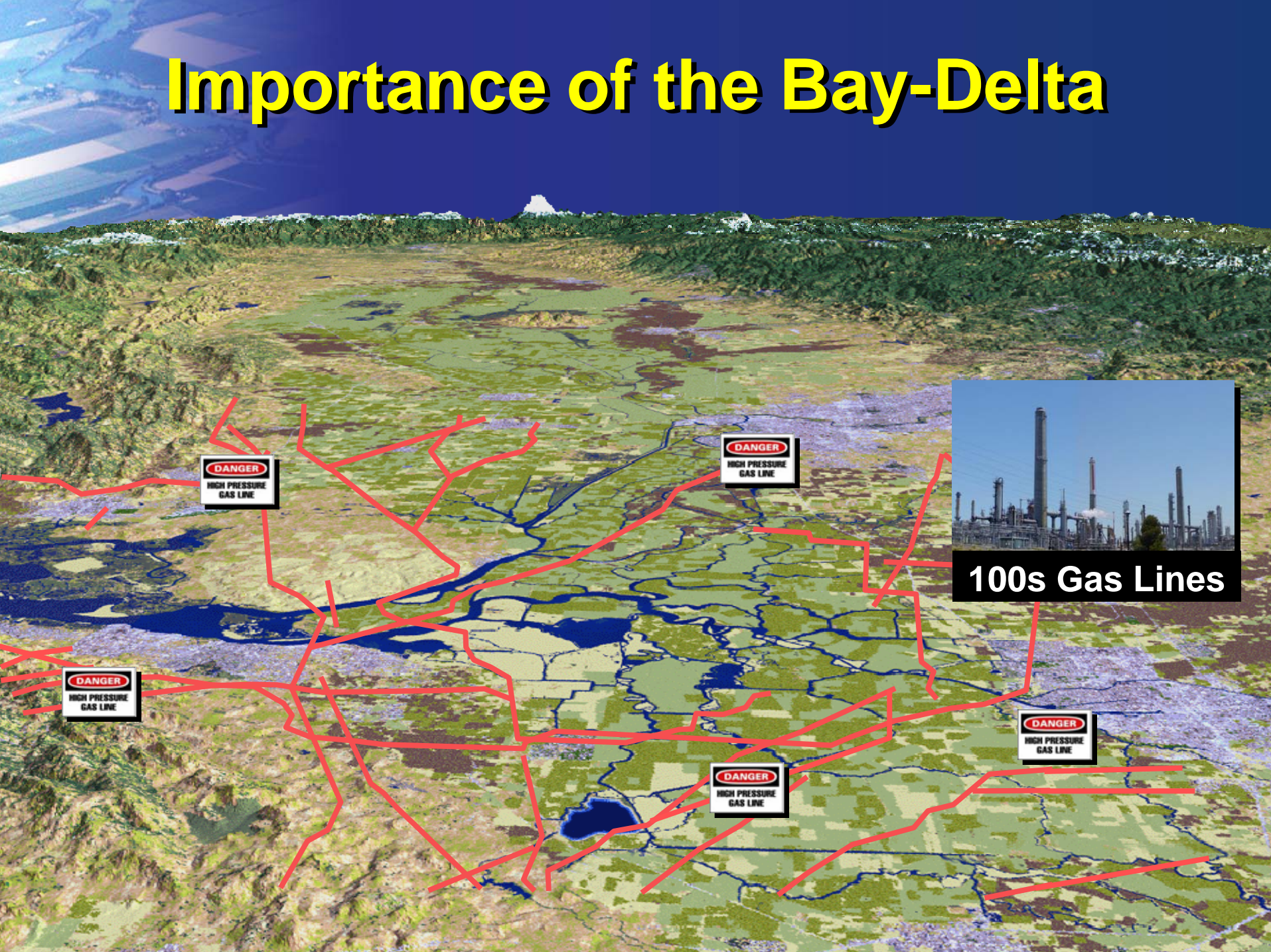
Importance of the Bay-Delta



3 Railroads

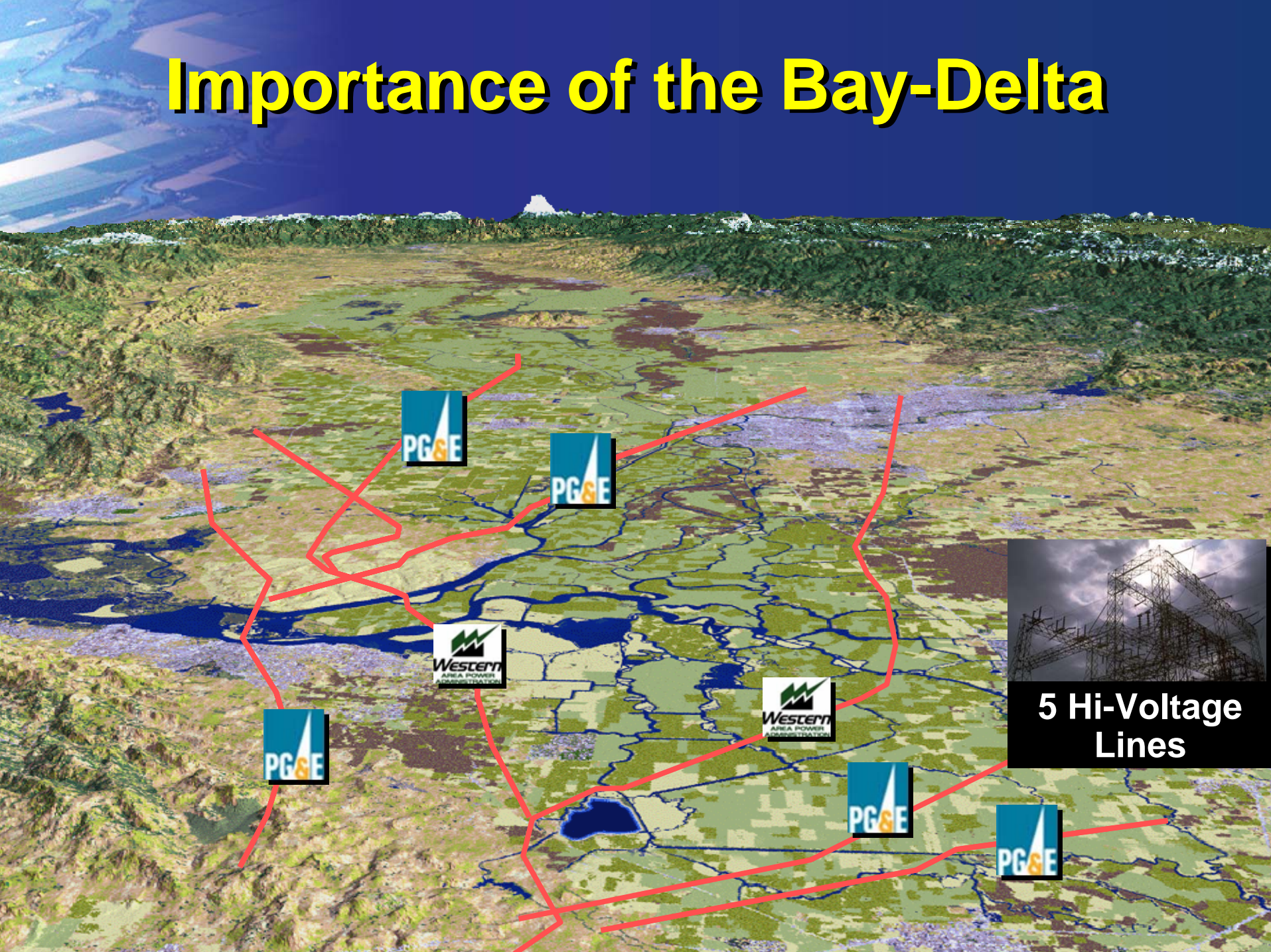


Importance of the Bay-Delta



100s Gas Lines

Importance of the Bay-Delta



**5 Hi-Voltage
Lines**

Importance of the Bay-Delta



160,000 Homes



3 Highways



3 Railroads



100s Gas Lines



5 Hi-Voltage Lines



Delta Inflow

Sacramento River

~80% Inflow; good quality

East Side Rivers

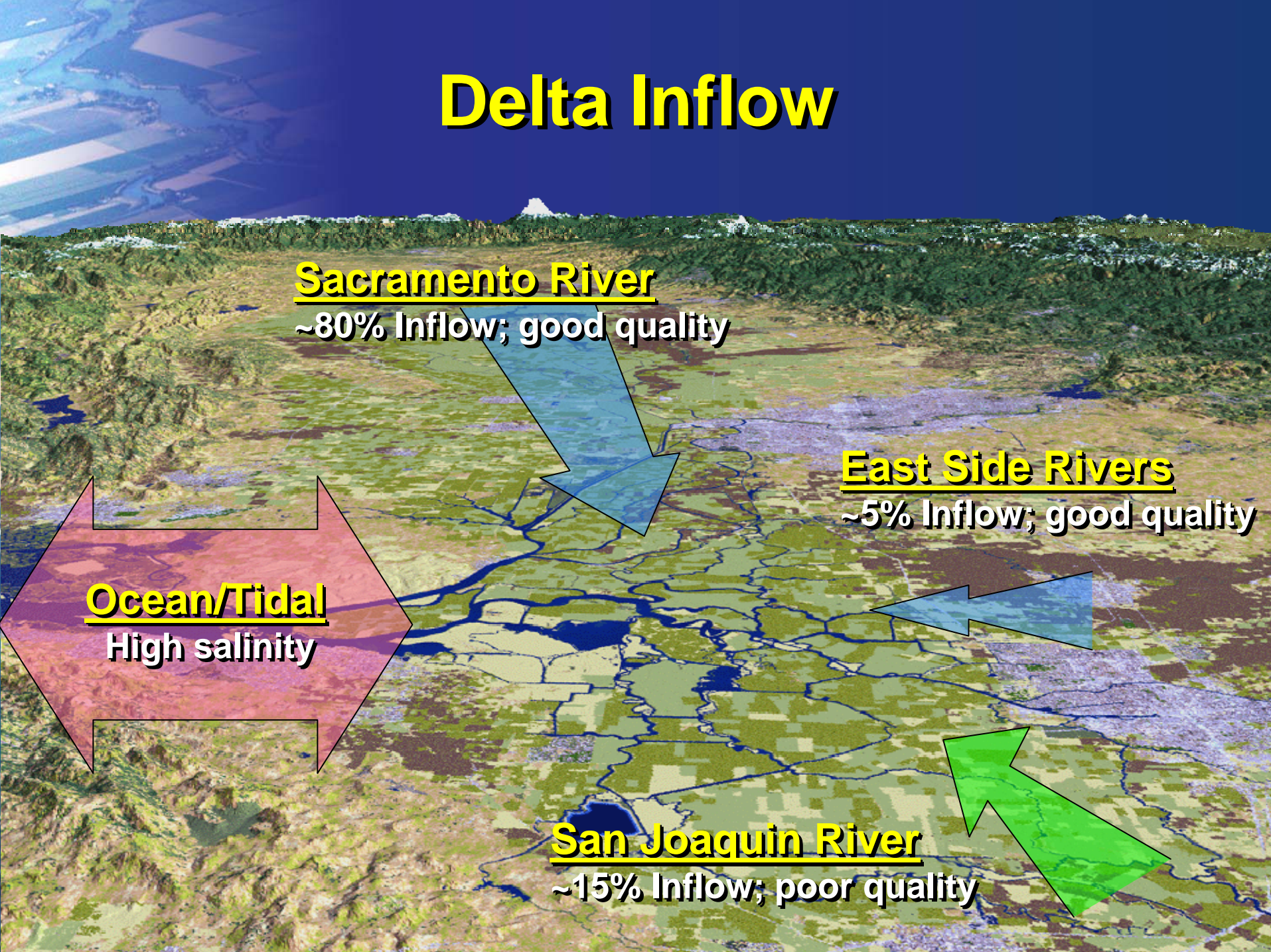
~5% Inflow; good quality

Ocean/Tidal

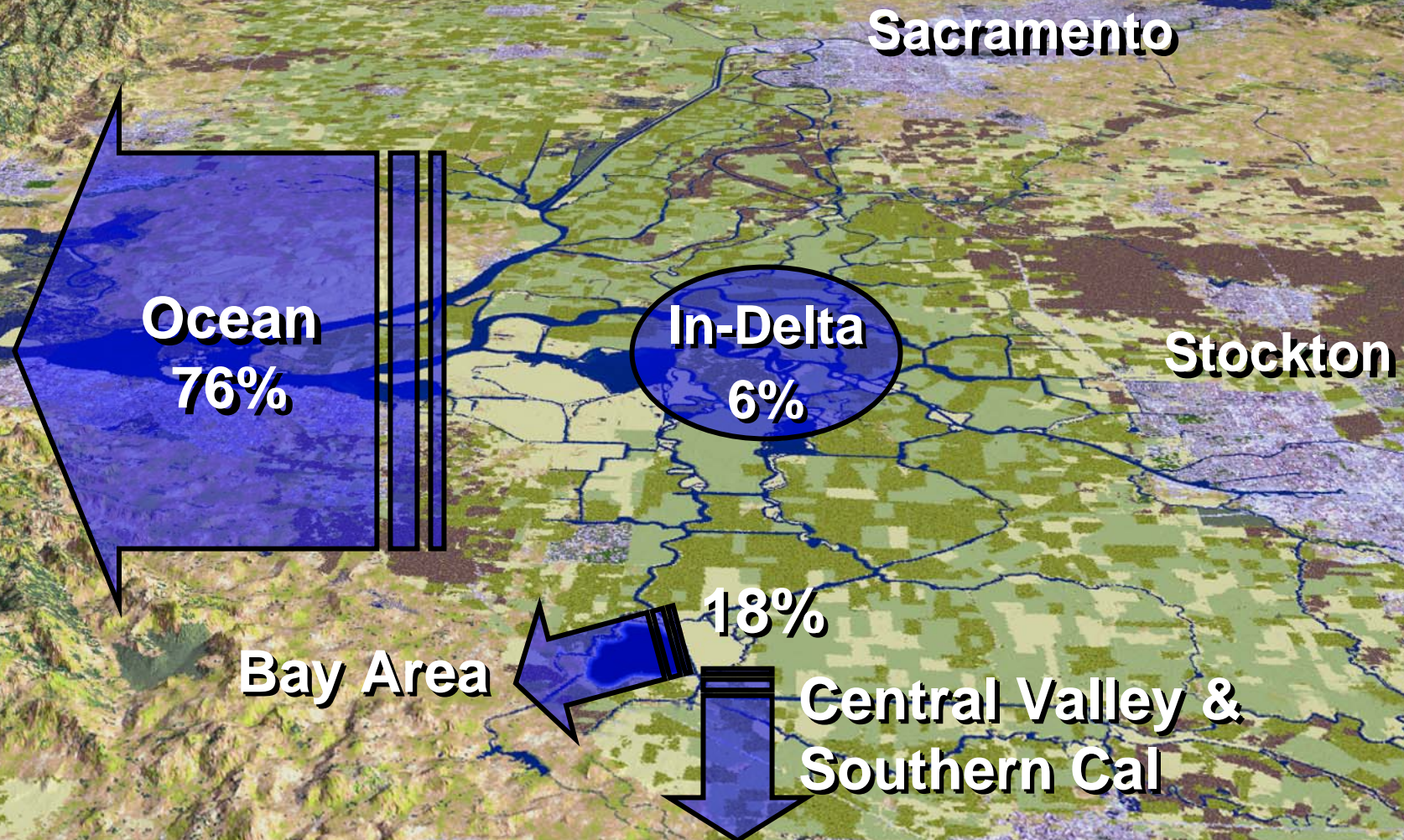
High salinity

San Joaquin River

~15% Inflow; poor quality



Delta Water Use



Key Water Supply Infrastructure

North Bay
Aqueduct

Delta
Cross
Channel

Delta Cross
Channel

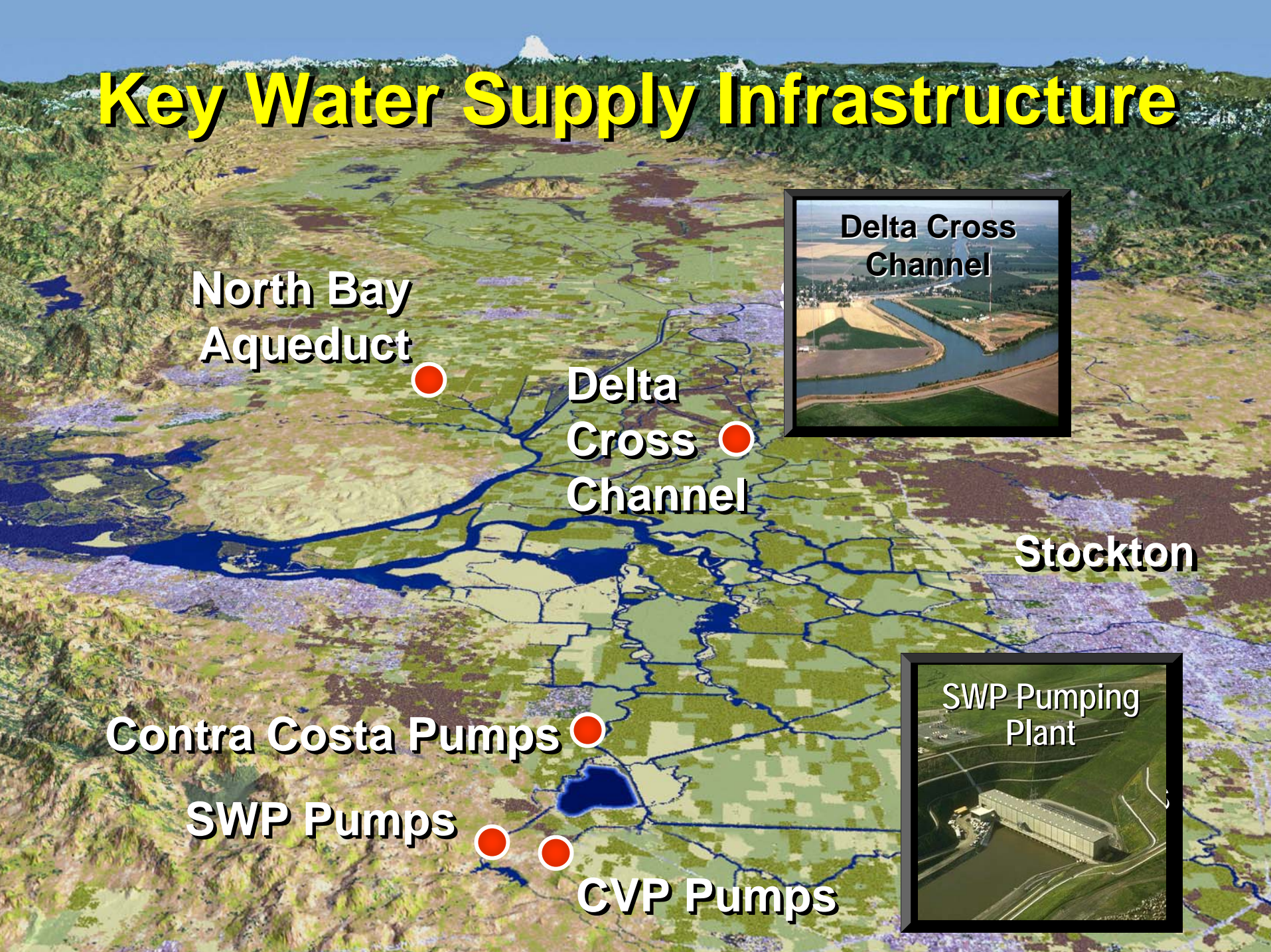
Stockton

Contra Costa Pumps

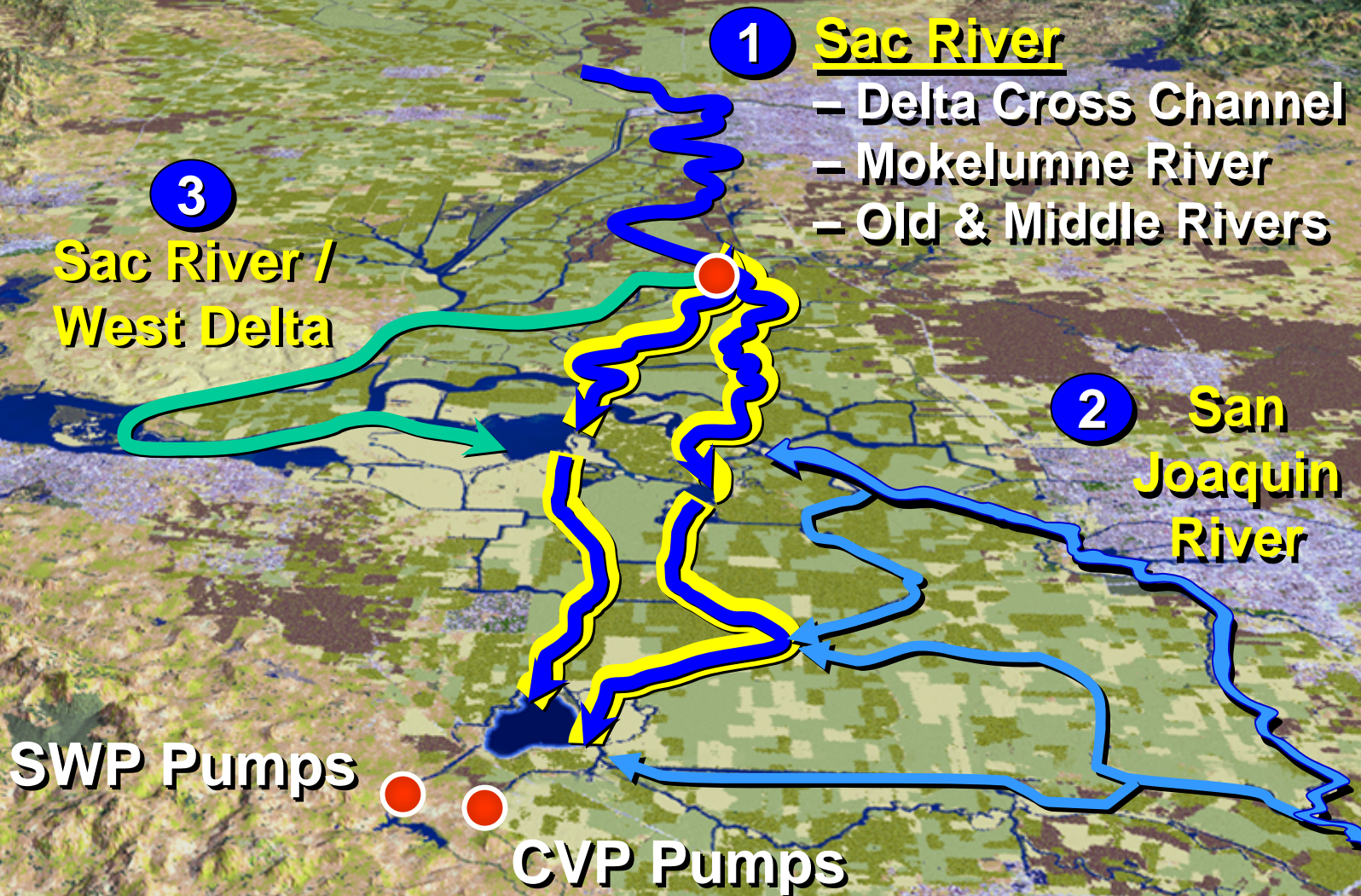
SWP Pumps

CVP Pumps

SWP Pumping
Plant



How Water Gets to State and Federal Pumps



California's Bay-Delta

History and Management Issues



Overview

Background

Risks

Consequences

The Delta – The Risks are Intensifying

Hurricane Katrina



2000

1500

1000

500

0

Delta smelt



1967 1973 1979 1985 1991 1997 2003

Jones Tract (2004)



Six Factors that Intensify Future Risks



- Subsidence
- Sea level rise
- Regional climate change
- Seismicity
- Exotic species and ecosystem change
- Population growth and urbanization



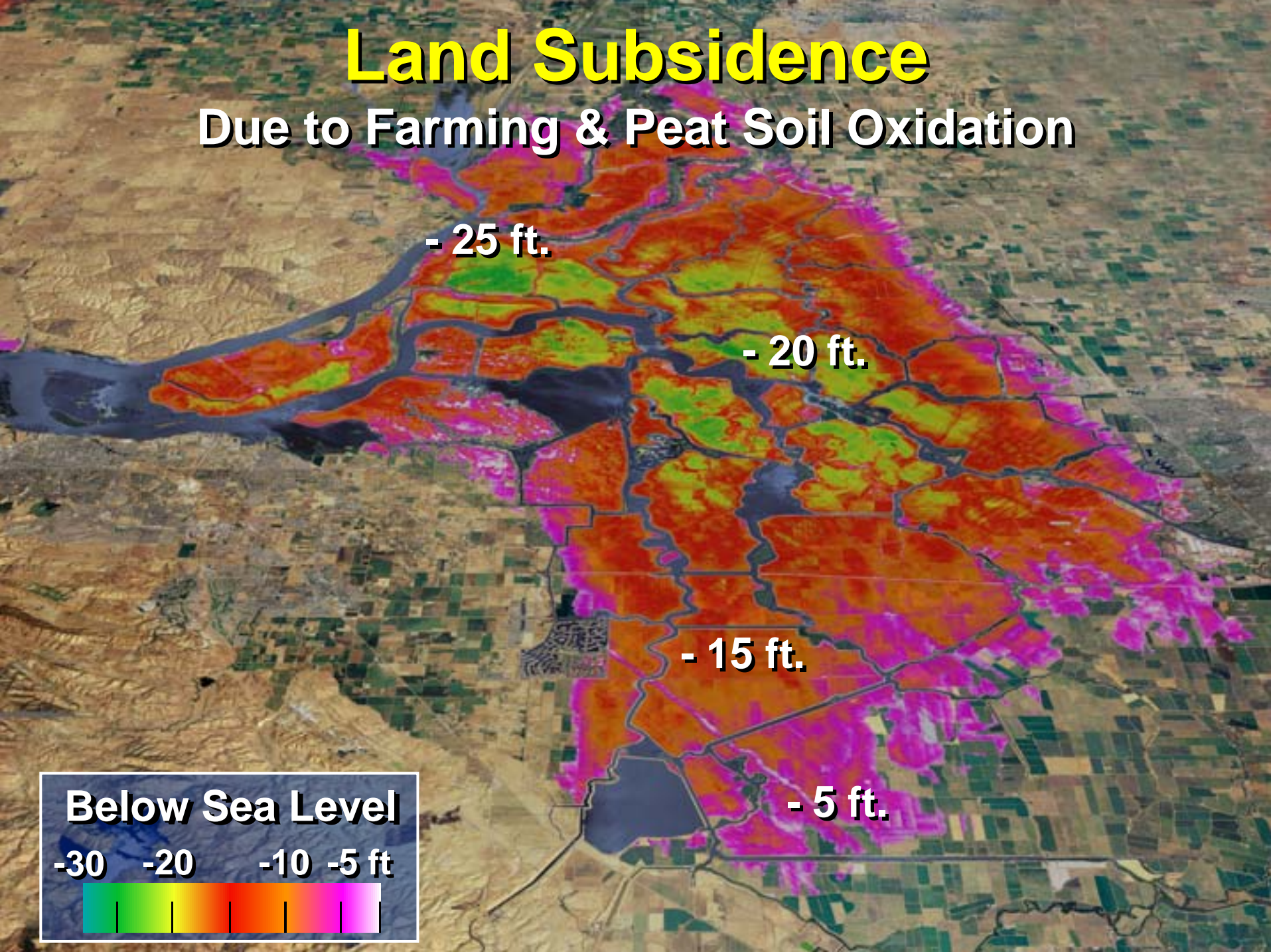
Island Land Subsidence

- ~ 1.5 ft. per decade
- 30+ feet in some areas



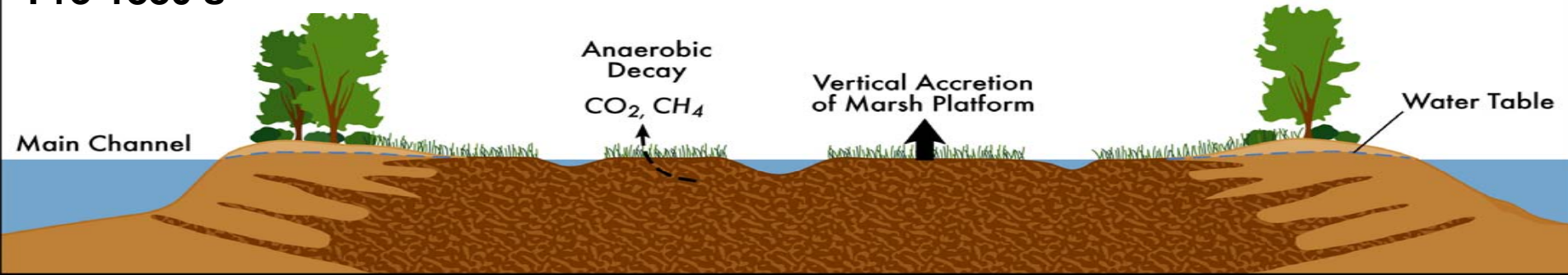
Land Subsidence

Due to Farming & Peat Soil Oxidation

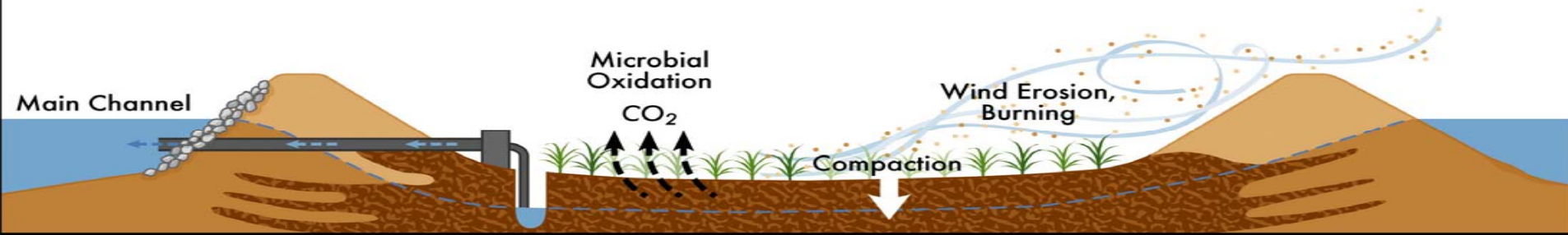


Land Subsidence -- Islands or Holes?

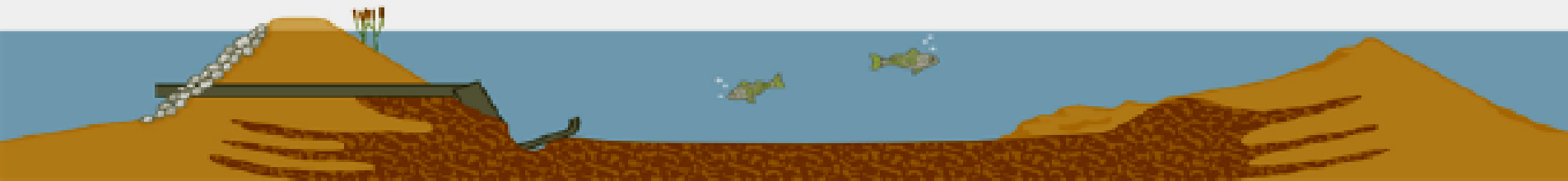
Pre-1880's



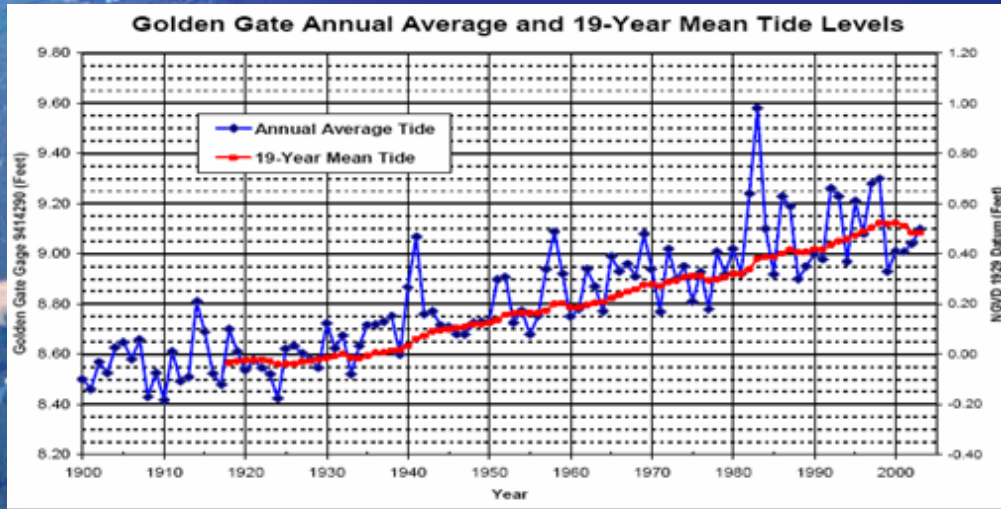
Present Time



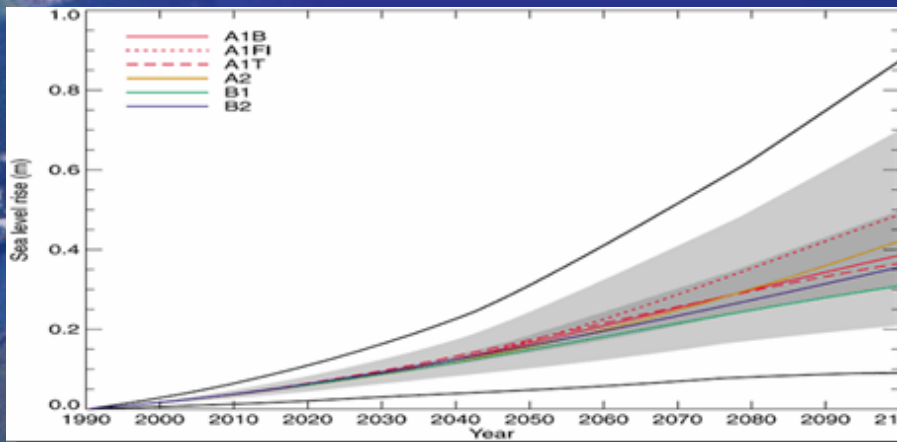
Levee Failure



Sea Level Rise



Past (1900 – 2000)
+ ½ ft sea level rise



Future (2000 – 2100)
2 to 3 ft sea level rise

Regional Climate Change



**Air
temperature**

By 2100

+ 1.4 – 5.8 °C degrees

By 2050

1/3 loss of snowpack



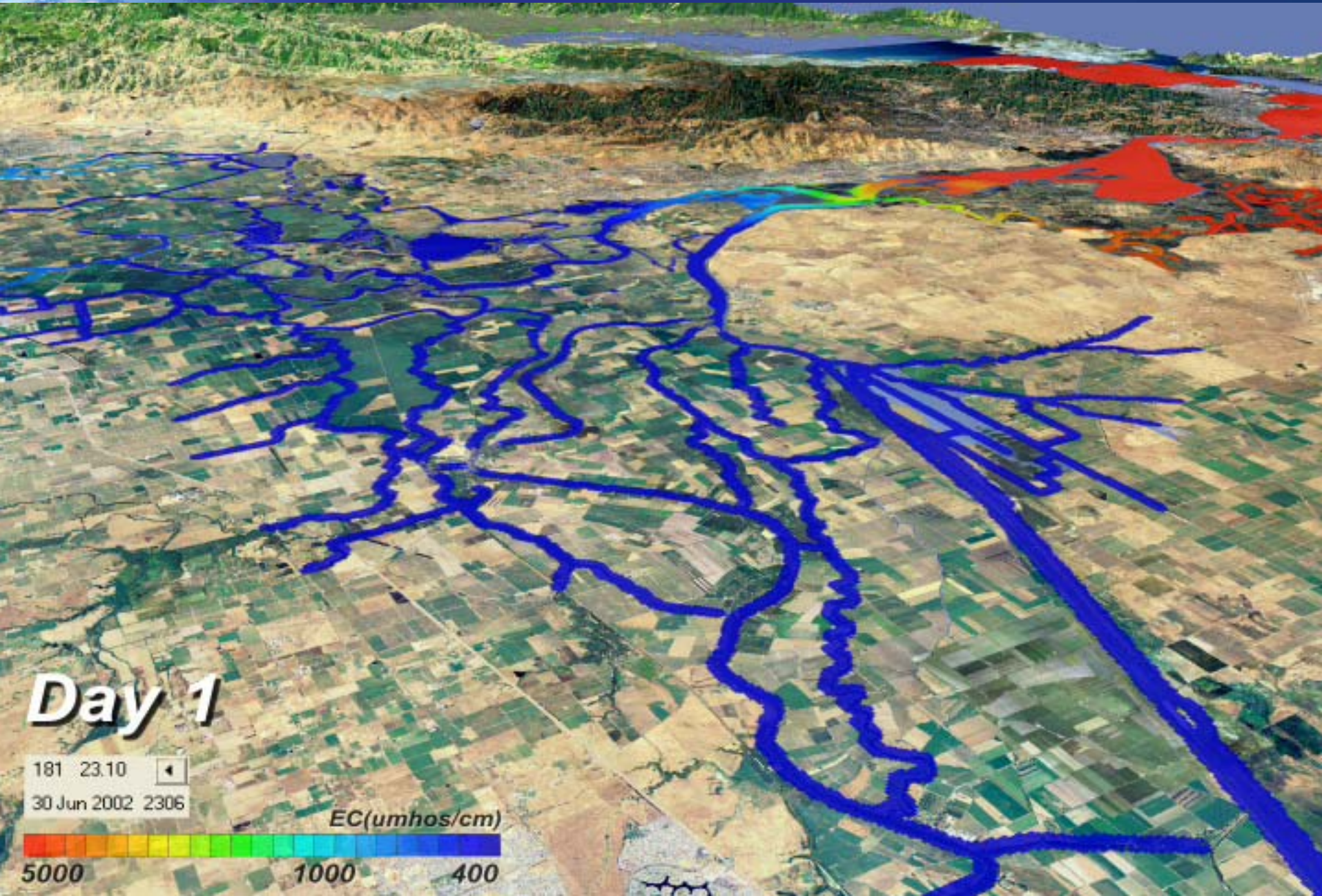
Snowpack

Seismic Vulnerability



Bay Delta Region Major Faults

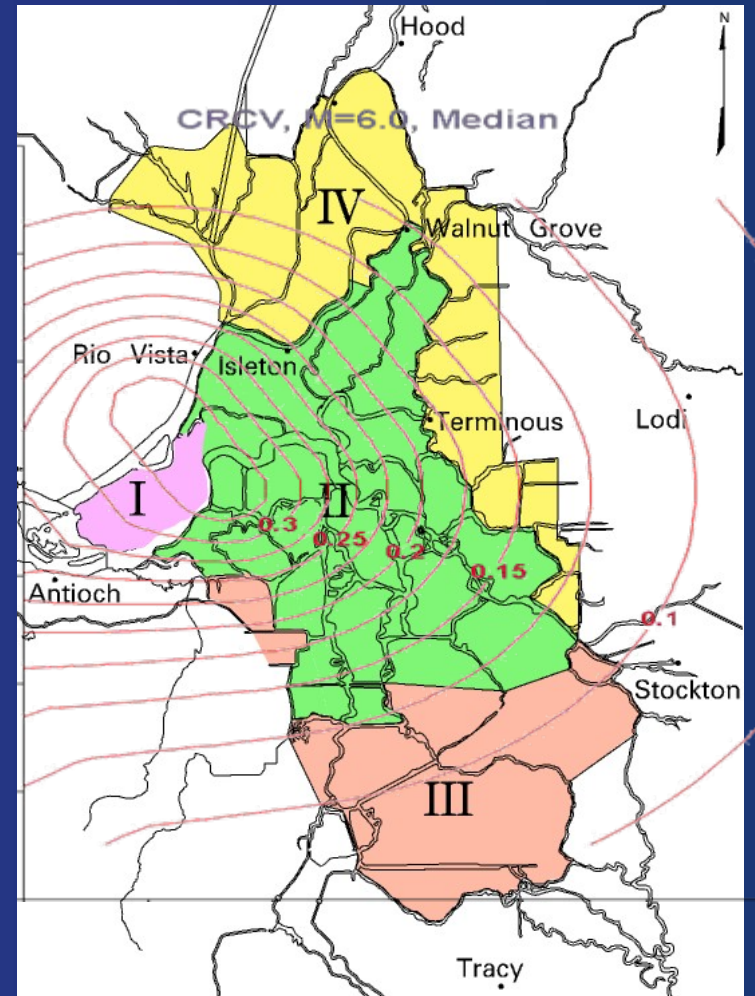
6.5 Richter Earthquake & 20-Island Failure



Hypothetical Scenario

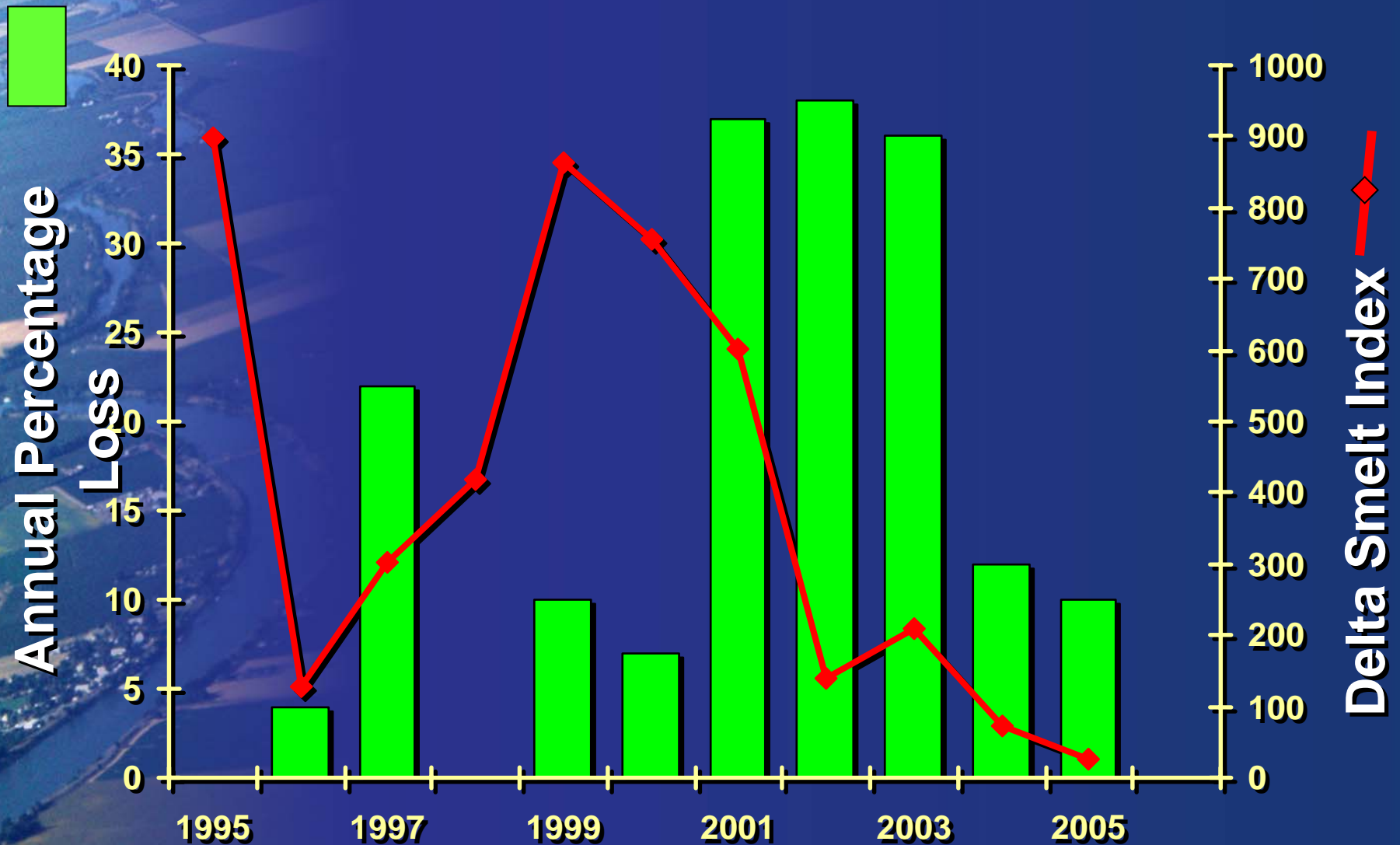
A 6.5 magnitude earthquake in the western Delta:

- 30 levee breaks
- 20 islands flooded
- Water quality degraded
- 200 miles of levees weakened by slumping, cracking and increased seepage
- Increased pressure on the system - future levee failures



Kimmerer & Brown (USGS)

Estimates of Pumping Impacts on Delta Smelt



Urbanization



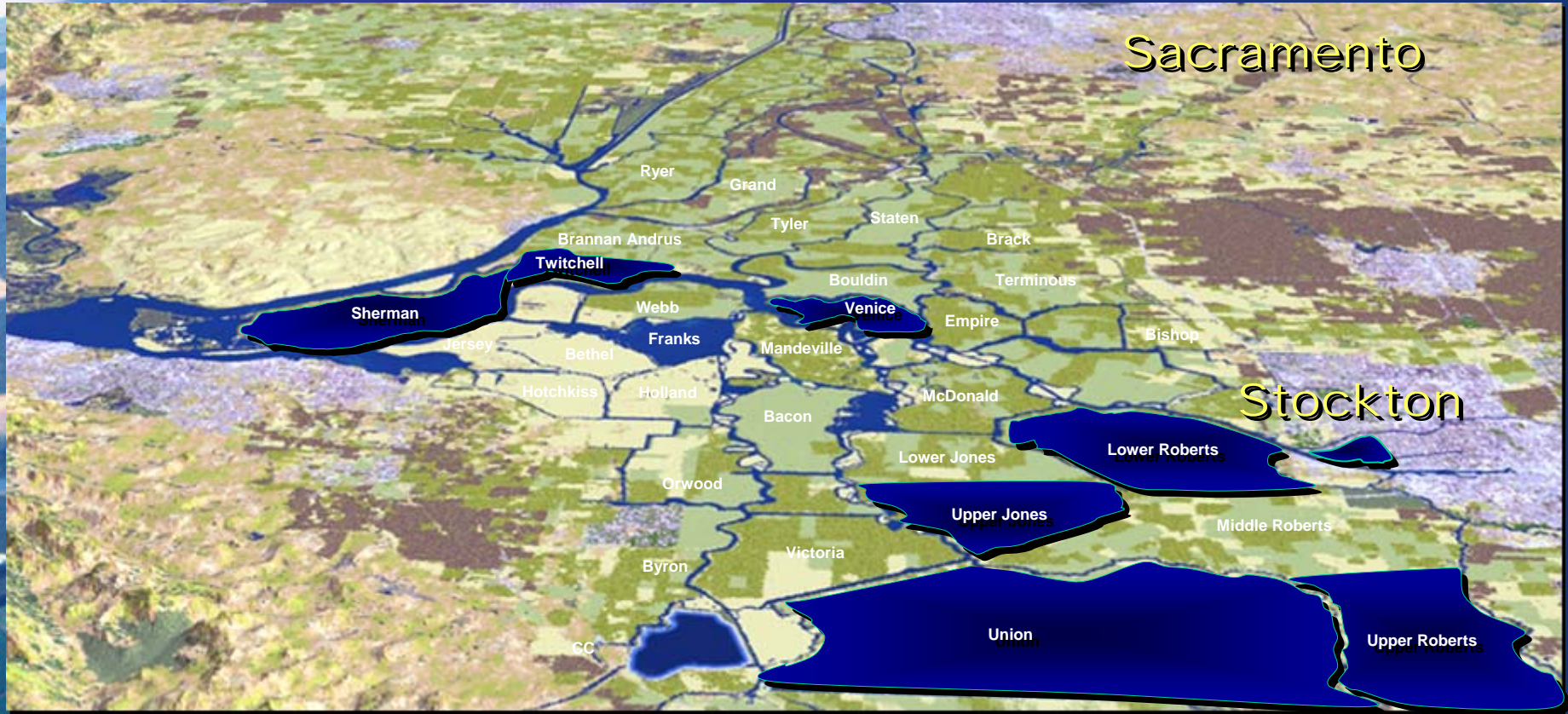
- Fastest growing region in California
- Increasing population and water supply pressures
- Demand for conversion of the Delta to homes
- 130,000 homes = about 55,000 acres

Historic Flood & Levee Failures

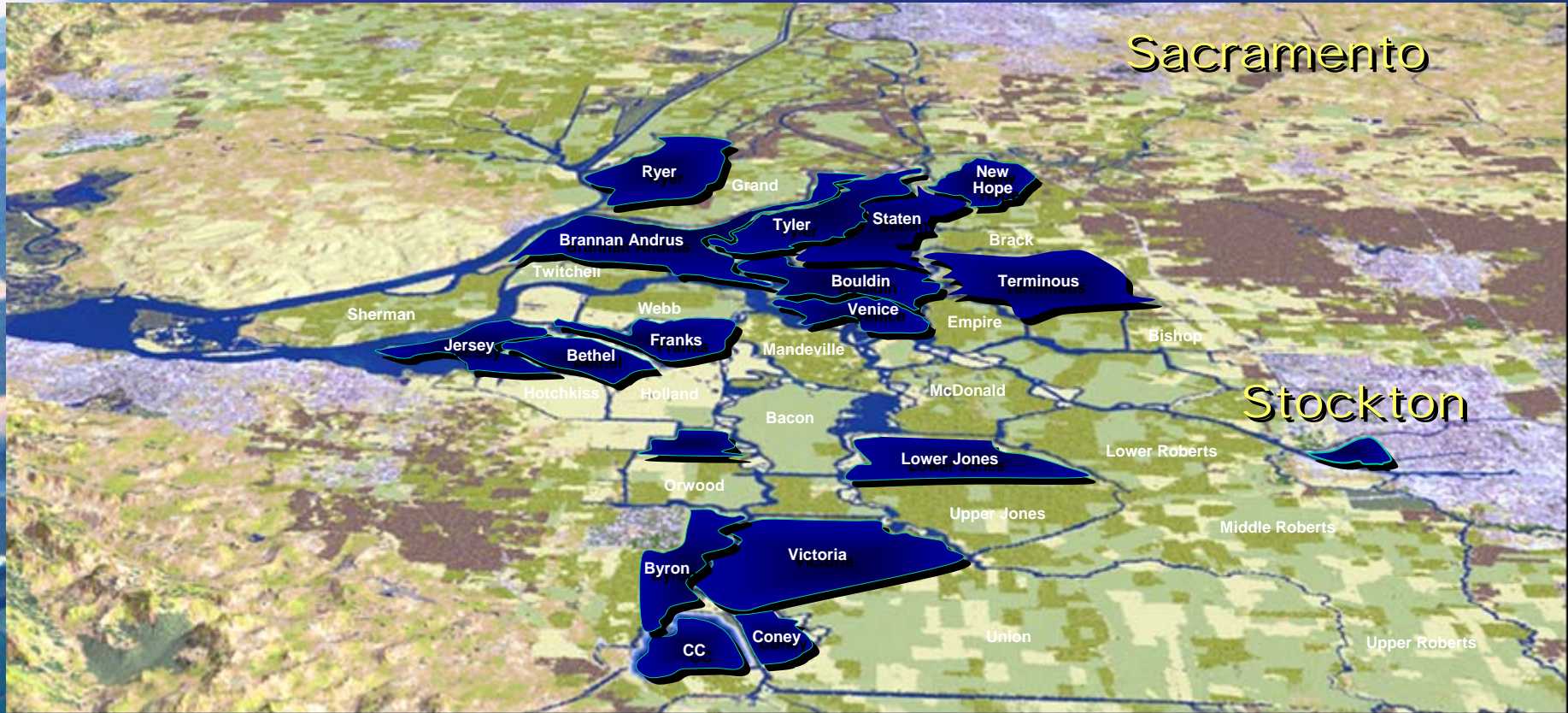
An aerial photograph of a river delta, likely the Mississippi River Delta, showing a complex network of waterways and land. The land is color-coded to indicate different levels of risk or land use. A large, dark blue area in the center represents a major water body or a high-risk flood zone. The surrounding land is divided into patches of green, yellow, and brown, with some areas highlighted in purple. The background shows a range of mountains under a clear blue sky.

- 162 levee failures in last 100 years
- 64% chance of major earthquake or flood by 2032

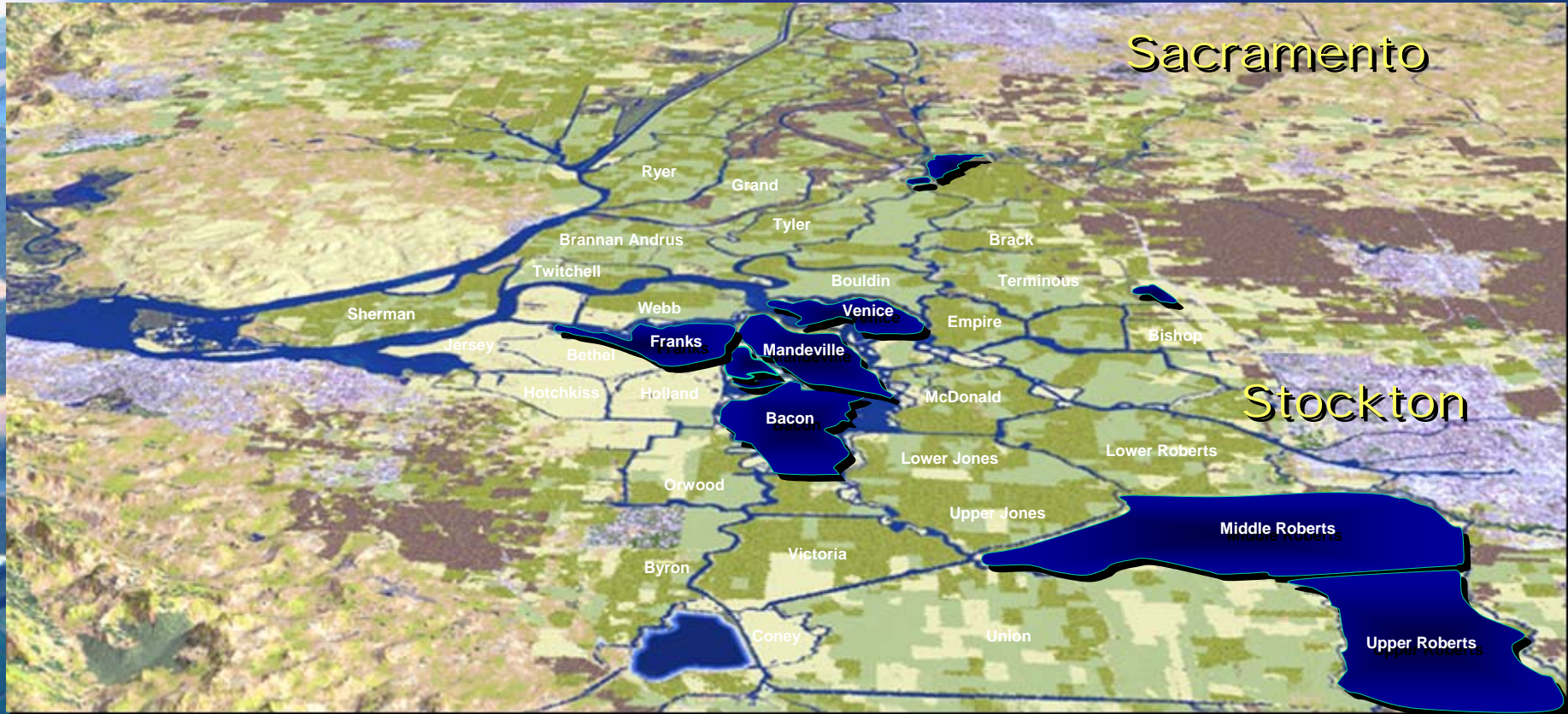
Year 1906



Year 1907



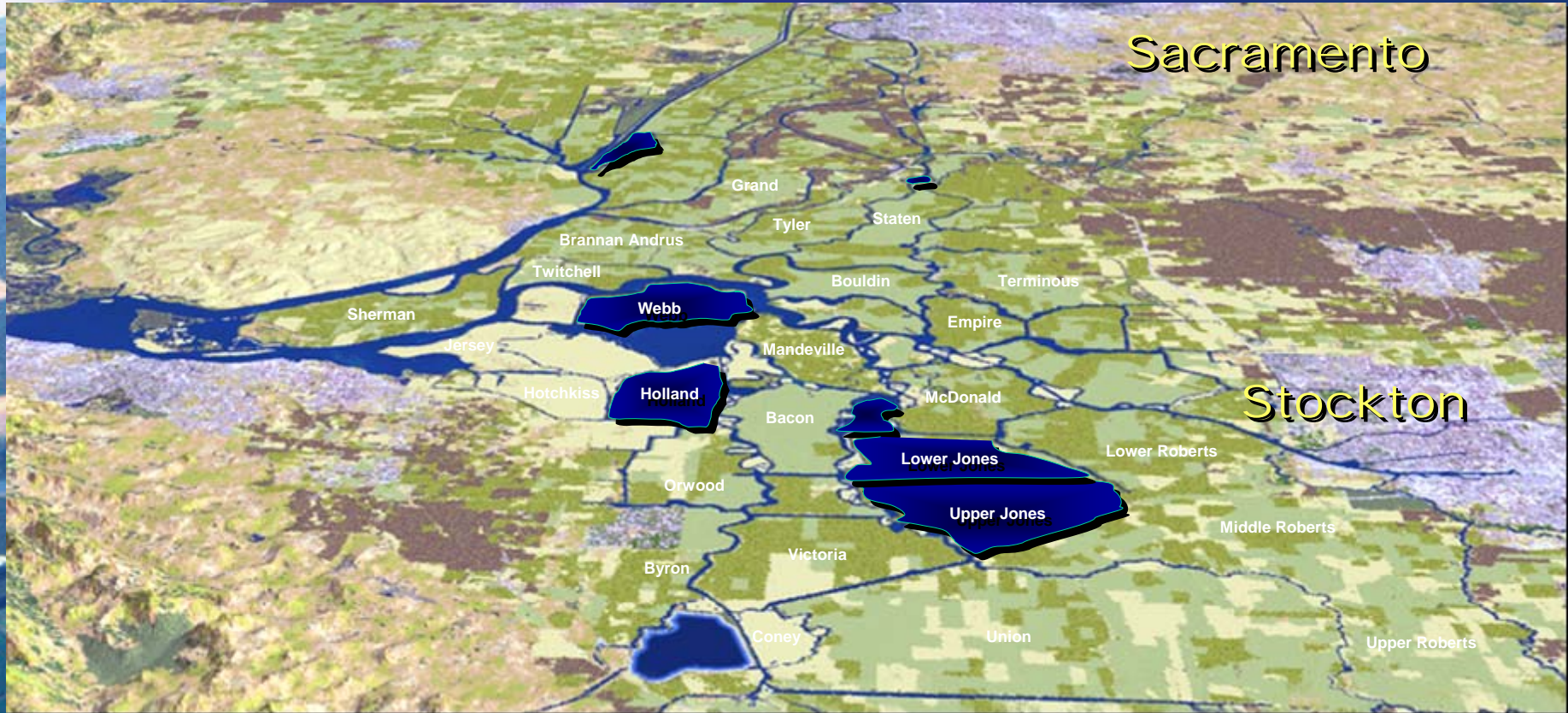
Year 1938



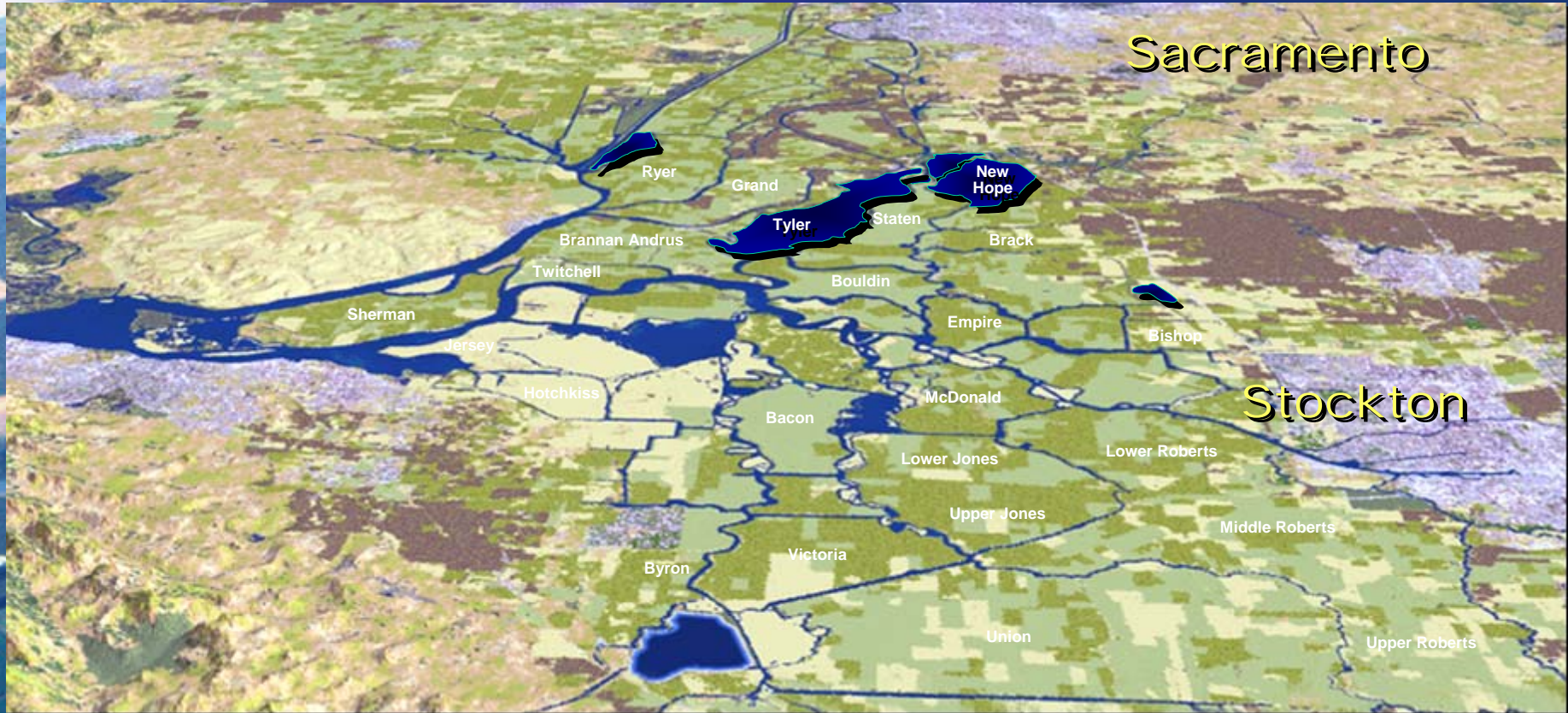
Year 1950



Year 1980



Year 1986



Jones Tract (2004)



An aerial photograph of a river delta, showing a network of channels and distributaries flowing into a larger body of water. The land is divided into a patchwork of green and brown fields. A blue gradient overlay covers the right half of the image, where the title is located.

Consequences of a Major Seismic Event

Initial Impacts

- Exports cease & do not resume for the foreseeable future
- Levee damage causes Mokelumne Aqueduct failure

Mokelumne Aqueduct

Contra Costa 

SWP   CVP

Initial Impacts



■ Infrastructure Failures

- Hwy 12 & 160 flooded
- Natural gas and oil pipeline ruptures
- Railroad embankment failure

■ Resulting In

- Major transportation disruption in Bay-Delta region
- Interruption of rail and truck deliveries
- Shortage in natural gas
- Hazardous spills and cleanup

Initial Impacts



- Levee failures partially block Stockton Deep Water Channel
- Port of Stockton shut down until dredging reopens channel

Initial Impacts



- 85,000 acres of ag land & crops flooded
- 3,000 homes inundated

Initial Impacts



- Command posts setup in Rio Vista, Stockton & Antioch
- Rescue operations conducted (Coast Guard, National Guard, Sheriff & Police)
- CDF & CCC crews mobilized to lay plastic & sandbags to reduce wave erosion
- Access to islands limited; inhibits emergency efforts

Initial Impacts



- Flood fights on non-flooded islands due to increased seepage
- Available barge-mounted cranes mobilized to armor levee edges
- Additional cranes, tugs & barges requested from Long Beach & Seattle
- 2 to 4 weeks for additional equipment to arrive
- Damage to other infrastructure competes for response assets

Extended Impacts



■ **Water Availability**

- **Levee repairs will require at least 15 months; More realistically, the repairs will take longer**
- **Southern Cal agencies drawing from reserves; Some will last 24 months; others will go dry sooner**
- **Extreme conservation measures enacted**
- **Groundwater basins drawn down – may lead to contamination**
- **Water conservation & transfer programs enacted**

Extended Impacts



■ **Water Quality**

- **Brackish water remains in deep pools along remnant levees**

■ **Fisheries**

- **Impact to endangered species & food chain unknown; Likely, some species would benefit & others would be severely hurt**

Extended Impacts



■ One-Year Later

- Efforts to close breaches are incomplete
- Additional levees have failed due to insufficient equipment & materials to repair them
- Wind-driven waves have eaten away 20% of the levees on 9 islands
- More breaches than immediately after earthquake
- Levee damage at least \$6 billion

Extended Impacts



■ Water Supply Response

- After one year, only 7 islands have been saved
- Efforts to recover remaining islands abandoned
- Rock barriers are placed in waterways to reroute the San Joaquin River to the SWP & CVP pumps
- Barriers take 1 month & 130,000 tons of rock

Overall Consequences

- \$30 - 40 billion loss to California's economy
- Job losses exceed 30,000

Future Delta Management: Band aids or Sustainable Solutions?

